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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Sean S. Kang

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BEYER WEAVER & THOMAS, LLP

P.O. BOX 70250

OAKLAND, CA 94612-0250

EXAMINER

MALDONADO, JULIO J

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 07/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/648,953	Applicant(s) KANG ET AL.	
	Examiner Julio J. Maldonado	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-12,14-17,21-27,29-36,38 and 39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-23,25-27,35 and 36 is/are allowed.
- 6) ☒ Claim(s) 1,3-12,14-17,24,29,30,32 and 33 is/are rejected.
- 7) ☒ Claim(s) 31,34,38 and 39 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>20050331</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The rejection as set forth in the Office Action mailed on 02/23/2006 is withdrawn in further review of claim 24.
2. Claims 1, 3-12, 14-17, 21-27, 29-36, 38 and 39 are pending in the Application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-12, 14-17, 29, 30, 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al. (U.S. 5,895,740) in view of the following comments.

In reference to claims 1, 3, 6, 9, 10 12, 14, 15, 16, 32 and 33, Chien et al. (Figs.3-5) teach a method of in situ forming a hole and conformal layers including the steps of forming a photoresist layer over a dielectric layer (34); patterning the photoresist layer to form photoresist features (38) with photoresist sidewalls (48), where the photoresist features (38) have a first critical dimension; plasma depositing a conformal layer (44) over the sidewalls (48) of the photoresist features (38) to reduce the critical dimensions of the photoresist features (38), wherein said conformal layer (44) is an organic polymer layer, wherein forming said polymer conformal layer (44) further includes controlling the reactant gas mixture ratio, power applied to the chamber, chamber pressure and cooling gas flow rate for the further advantage of achieving

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uniform thickness along the photoresist sidewalls (48) and furthermore to control the thickness of said conformal layer (44) in order to control the size of the hole to be etched in the dielectric layer (34) and wherein the sidewall thickness is greater than a photoresist feature bottom thickness; and etching a hole (52) into the dielectric layer (34), wherein said hole (52) have a second critical dimension which is less than the first critical dimension, and wherein the forming of the conformal layer (44) and the etching of the dielectric layer (34) is performed in situ (column 4, line 60 – column 6, line 50).

Chien et al. fail to expressly teach said conformal layer depositing step includes a first and third deposition with a first gas chemistry to form a first deposition plasma and a second and fourth deposition with a second gas chemistry to form a second deposition plasma, wherein the first gas chemistry is different than the second gas chemistry. However, Chien et al. discloses that the changes of ratio are a result of effective variable that affects the thickness of the deposited layer (Chien et al., column 5, lines 43 – 62). It would have been obvious to one of ordinary skill in the art at the time the invention was made to change the reacting gas ratio to an amount which would not be expected to significantly affect the characteristics of the deposition process, that is, the claim is open to extremely small changes that would make them insignificant changes in ratios.

Chien et al. substantially teach all aspects of the invention but fail to disclose wherein the second critical dimension is not greater than 70% of the first critical dimension. However, Chien et al. teach wherein forming said polymer conformal layer includes controlling the reactant gas mixture ratio, power applied to the chamber,

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chamber pressure and cooling gas flow rate for the further advantage of achieving constant thickness along the photoresist sidewalls and furthermore to control the thickness of said conformal layer in order to control the size of the hole to be etched in the dielectric layer (column 5, lines 43 – 61). Therefore, the selection of the claimed percent range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a hole with a desired critical thickness. Accordingly it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Chien et al. to arrive at the claimed invention.

Chien et al. substantially teach all aspects of the invention but fail to disclose wherein the photoresist layer is formed from 248 nm photoresist and the feature has a CD not greater than 140. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert.

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denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

In reference to claims 5 and 17, Chien et al. teach wherein the depositing the conformal layer over the sidewalls forms substantially vertical sidewalls (column 4, line 60 – column 6, line 50).

In reference to claims 7, 8 and 30, Chien et al. substantially teach all aspects of the invention but fail to disclose stripping the photoresist mask and deposited conformal layer with a single stripping step, wherein said stripping comprises ashing the photoresist mask and the deposited layer. However Chien et al. teach removing the photoresist mask using an ashing process (Chien et al., column 6, lines 44 – 50). Furthermore, the conformal layer used in Chien et al. is made out of fluoropolymers using reactants such as CHF_3 (Chien et al., column 5, lines 26 – 42), which is one of the materials used disclosed in the submitted specification (Instant page 12, lines 21 – 26).

Therefore, there would be an expectation that at least part of the conformal layer would be removed during an ashing process, because the same materials are treated the same way, and therefore, the same result would be obtained.

5. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yang (U.S. 5,296,410) in view of Moslehi (U.S. 5,273,609).

Yang (Figs.4-7) teaches a method of forming conductive lines including placing a conductive layer (20) over a substrate (10, 12); forming a mask (30), wherein the mask (30) defines a plurality of mask lines with mask spaces between the mask lines, wherein the mask spaces have a width and wherein the mask lines have a width and have

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sidewalls; placing the substrate (10,12) in a plasma processing chamber; depositing a conformal layer (50) over the sidewalls of the mask (30), while the substrate (10, 12) is in the plasma processing chamber; and etching the conductive layer (20) through the mask (30) to form conductive lines (38) and spaces between the conductive lines (38) (Yang, column 3, line 54 – column 4, line 35).

Yang fails to teach depositing the conformal layer and etching said substrate in said plasma processing chamber. However, Moslehi (Fig.1) teaches a process to manufacture semiconductor devices including a plasma in situ processing chamber capable of thin film deposition and etching (column 7, line 60 – column 8, line 9).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Yang and Moslehi to enable depositing the conformal layer and etching of the conductive layer of Yang in the processing chamber according to Moslehi, for the further advantage of reducing the processing time involved during gas processing cycles (Moslehi, column 4, lines 56 – 60).

The combined teachings of Yang and Moslehi fail to teach wherein the widths of the conductive lines is greater than the widths of the line masks, wherein the widths of the mask spaces is more than 50% greater than the widths of the spaces between the conductive lines. One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere

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dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Allowable Subject Matter

6. Claims 21-23, 25-27, 35 and 36 are allowed.
7. Claims 31, 34, 38 and 39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach wherein the depositing the conformal layer provides a portion of the bottom of the via without deposited conformal layer as recited in claims 21-23, 25-27, 31 and 34; and wherein the first and second deposition are selected from the group of a bread-loafing depositing and a faceting depositing, and wherein the first deposition is different from the second deposition as recited in claims 38 and 39.

Response to Arguments

8. Applicant's arguments filed 5/23/2006 have been fully considered but they are not persuasive.

In regards to Chien et al., Applicants argue, "...one set of processing parameters may be selected to provide a thinner polymeric layer and another set of processing may be selected to provide a thicker polymeric layer. Nothing in the cited section teaches changing the process parameters during the deposition or that the process parameters would change during the deposition. Therefore, the Examiner failed to point out anything in Chien et al. that teaches or suggests the formation of a conformal layer by a first and second deposition of first and second gas chemistries...". In response to this argument, Chien et al. teach "... It should be noted that during the polymeric material deposition process, a layer of the material is deposited to uniformly cover the sidewalls 48 of the openings 42 in the photoresist layer 38 and the exposed areas 52 on the dielectric layer 34. In the deposition process, the thickness and the quality of the polymeric layer which ultimately determines the final diameter of the contact holes formed, i.e., the thicker the polymeric material layer which produces a thicker polymeric sidewall spacer and subsequently a smaller contact hole are determined and controlled by the reactant gas mixture ratio (of C.sub.4 F.sub.8 /CHF.sub.3 /CO), the power applied to the chamber, the chamber pressure and the helium cooling gas flow rate..." (Chien et al., column 5, lines 43 – 62). The claims are open to changing only one parameter only one time during the deposition process to a "different" value which is close enough to the original value that one of ordinary skill in the art at the time the invention was made would have had a reasonable expectation of success in obtaining the disclosed outcome of the step. Although one of ordinary skill in the art at the time the invention was made would expect that there would be a difference in the result of

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the process that difference would be expected to be insignificant to the outcome of the process in that substantially the same result would be obtained. The claim is open to the different value and the original value both being within the range encompassed through disclosure of "approximately" when disclosing the values (Chien et al., column 5, lines 27 – 62) further providing a reasonable expectation of success that the process wherein the value is changed to a "different" value would produce the disclosed outcome.

Furthermore, and as stated in the rejection hereinabove, although Chien et al. fail to disclose wherein the second critical dimension is not greater than 70% of the first critical dimension, Chien et al. teach wherein forming said polymer conformal layer includes controlling the reactant gas mixture ratio, power applied to the chamber, chamber pressure and cooling gas flow rate for the further advantage of achieving constant thickness along the photoresist sidewalls and furthermore to control the thickness of said conformal layer in order to control the size of the hole to be etched in the dielectric layer (Chien et al., column 5, lines 43 – 61). Therefore, the selection of the claimed percent range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a hole with a desired critical thickness. Accordingly it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Chien et al. to arrive at the claimed invention.

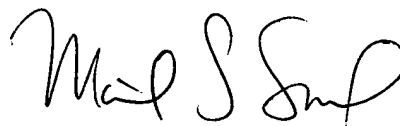
Conclusion

9. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.
10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.
11. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.



Julio J. Maldonado
July 12, 2006

Julio J. Maldonado
Patent Examiner
Art Unit 2823



MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800